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NUTRITIVE VALUE OF GREEN MASS AND HAY FROM THE DIVČIBARE REGION

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With the aim of forming a complete observation of the botanical composition and nutritive value of pasture and meadow hay from the Divčibare region, which is a typically hilly-mountain area in Serbia, investigations were designed to evaluate the quality of pasture and hay (chemical composition and energy value), as well as the losses which are results of drying pasture. Twelve samples of grass were taken from three different altitudes and after mowing, samples of hay were also taken from the same meadow.

In a conventional chemical analysis (Weende) the chemical composition of grass and hay were determined. On the basic of this analysis nutritive values were calculated. Pasture and hay from the Divčibare region have a satisfying chemical composition, they can be used as a forage base and a source of nutrients for ruminants, predominantly, low-producing livestock. The difference in content of proteins among samples from some localities might be bound with the content of fabaceae. The increase fibre content with the proportional decrease content of protein had a negative influence on the nutritive value in the samples of grass and hay.

The Net Energy Lactation (NEL) of hay from the investigated region is near the lower limit reported as average for pasture and meadow hay. Significant higher nutritive values of green mass, calculated on dry matter (NEL 8.35 MJ/kg, SV 0.78 SJ/kg) when compared to the nutritive value of hay (NEL 8.12 MJ/kg, SV 0.74 SJ/kg) show that losses are results of haymaking. Nutrients losses during drying are in correlation with losses of proteins, lipids and mineral matter, but there is an increase in fiber. The change in chemical composition due to the described losses during drying and the negative influence on organic matter digestibility, led to a reduction in the energy value of the investigated samples.

Key words: nutritive value; green mass; hay

ХРАНЛИВА ВРЕДНОСТ НА ЗЕЛЕНАТА МАСА И СЕНОТО ОД РЕГИОНОТ НА ДИВЧИБАРЕ

Со цел да формираме комплетна слика за ботаничкиот состав и хранливата вредност на пашата и ливадското сено од регионот на Дивчибаре, кој е типично високопланинско подрачје во Србија, извршивме евалуација на квалитетот на пашата и сеното (хемиски состав и енергетска вредност) и на загубите кои се резултат на сушење на пашата. Беа земени дванаесет проби од трева од три различни височини, и тоа по цутењето, додека пробите од сено беа земани секогаш од истото место. Со конвенционална хемиска анализа (методот на Weende) беше одреден хемискиот состав на тревата и сеното. Врз база на тие анализи беше пресметана хранливата вредност. Пашата и сеното од регионот на Дивчибаре имаа задоволувачки хемиски состав. Тие можат да бидат користени како крмна база и извор на хранливи материи за преживари, предоминатно, и за послабо продуктивни животни. Разликите во содржината на протеини кај повеќето проби од различни локалитети можеби се поврзани со присуството на растенија од фамилијата *Fabaceae*. Зголемувањето на содржината на влакно со пропорционалното намалување на содржината на протеини има

негативно влијание на хранливата вредност на пробите од трева и сено. Нето-енергијата за лактација (NEL) на сеното од истражуваниот регион е блиску до намалениот лимит реферирaн во литературата како просек за пашата и ливадското сено. Утврдена е значително повисока хранлива вредност на зелената маса, калкулирана на сува материја (NEL 8.35 MJ/kg; SV 0.78 SJ/kg), во споредба со хранливата вредност на сеното (NEL 8.12 MJ/kg, SV 0.74 SJ/kg), што покажува дека загубите се резултат на обработката на сеното. Загубите во хранливи материи за време на сушењето се во корелација со загубите на протеини, липиди и минерални материи, но не со зголемувањето на влакното. Промените во хемискиот состав опишани како загуби во текот на сушењето и негативното влијание врз сварливоста на органските материи доведуваат до намалување на енергетската вредност на испитуваните проби.

Клучни зборови: хранлива вредност; зелена маса, сено

1. INTRODUCTION

The green mass and hay are a good source of nutritious substances, indispensable in the diet of sheep, cattle and horses, and are included in the diet of pigs and poultry. The chemical composition of plants is affected by floristical diversities, soil composition, terms of growth, the state of maturity and the influence of the fertilizer. Green mass is used as fresh food or hay (naturally or artificially dried plant mass) or in the form of anhydrous meal and silage. Nutrition quality of forage varies and depends on the plant species, stage of growth, soil type, cultivation conditions and fertilizer treatment. Plant species, grasses, legumes and herbs determine the mineral profile of green mass as well as the chemical composition. The aim of the haymaking process is to reduce the moisture content and contribute to a longer use (storage) of plant food.

The hay is a good source of energy and proteins. The variation in the nutritive composition of hay occurs as a result of differences in botanical composition, the cutting phase as well as weather conditions of cutting. The process of drying and storage affects the loss in nutrition value, i.e. the quality of hay. An atmospheric condition, like rain, dew, leads to the loss of nutritive substances and the most easily soluble carbohydrates, protein and vitamins. Storing and saving the hay also reduce the protein content, and increase the content of cellulose (Muratović, 1998). It is believed that the losses in digestibly organic matter and protein are about 27% (McDonald et al., 1988), and the total losses during the drying of green plants, ranging in the limits of 10–50% (Ševković et al., 1991).

2. MATERIAL AND METHODS

For the estimation of chemical composition and energy value a total of 12 samples of green mass were taken from six different localities from three different altitudes, and after mowing, samples of hay were also taken from the same meadow. Chemical composition is determined by standard methods (Weende) at the Department of Nutrition, Faculty of Veterinary Medicine in Belgrade. In order to investigate the energy value of green mass and hay, it is determined by the net measure of productive energy value of feed (*NEL*, Net Energy for Lactation, MJ/kg DM) and the following mathematical expression were used:

$$NEL\ [\text{MJ/kg}] = ME \times [0.6 + 0.24 \times (q - 0.57)] \quad (1)$$

q (metabolic of energy) = BE/ME (Grbeša, 1993)

$$BE = 0.0226\, x_1 + 0.0407\, x_2 + 0.0192\, x_3 + 0.0172\, x_4 \quad (2)$$

where x_1 are crude proteins ($N \times 6.25$ g/kg DM), x_2 crude fat (g/kg DM), x_3 crude fibre (g/kg DM) and x_4 *N*-free extract (g/kg DM).

$$ME = 0.0152\, x_1 + 0.0342\, x_2 + 0.0128\, x_3 + 0.0159\, x_4 \quad (3)$$

where x_1 digestible proteins ($N \times 6.25$ g/kg DM), x_2 digestible fat (g/kg DM), x_3 digestible fibre (g/kg DM) and x_4 digestible *N*-free extract (g/kg DM).

For the calculation of metabolic energy digestible coefficients of 65, 50, 68 and 65%, i.e. 58, 48, 60 and 64% were used for crude protein, crude fat, cellulose and *N*-free extract of green mass and hay. Calculating the material of the unit of energy as a measure of net productivity of feed energy (starch value, SJ/kg), digestible coefficients were used of 65, 50, 68 and 65%, i.e. 58, 48, 60 and 64% for crude protein, crude fat, cellulose and N-free extract of green mass and hay. Starch value as a measure of productive effects of feed is calculated using the following mathematical expression:

$$SV\ [SJ/kg] = 0.94\ x_1 + 1.91\ x_2 + 1.00\ x_3 + \\ + 1.00\ x_4 - A\ x_3 \quad (4)$$

where x_1 digestible proteins (g/kg DM), x_2 digestible fat (g/kg DM), x_3 digestible fibre (g/kg DM) and x_4 digestible *N*-free extract (g/kg DM). *A* is 0.38 for green mass and 0.58 for hay (Sinovec and Ševković, 1995).

3. RESULTS AND DISCUSSION

According to the investigations of green mass and hay from three different altitudes of Divčibare, established chemical composition is presented in Table 1.

Net Energy for Lactation (NEL) and Starch Values (SV) in samples of green mass and hay from three different altitudes of Divčibare are presented in Table 2.

Derived testing found the average energy value of green mass of NEL 8.35 MJ/kg DM and SV 0.78 SJ/kg DM, which is in relation to the higher content of literature data. Stekar et al. (1989) report that the energy value of green mass are around 6.07 MJ/kg, or 0.63 SJ/kg. Muratović (1998) presents data of 5.08–6.08 MJ/kg, and 0.74–0.88 SV/kg DM. *NEL* values obtained are slightly higher than listed, and the differences can be attributed to different quality of the green mass, more particularly cellulose content, as well as equations that are applied to calculate energy values. The starch unit of green mass is similar as reported by Muratović (1998).

Table 1

Chemical composition of green mass and hay of Divčibare [%]

Localities (above sea level)	Moisture	Ash	Proteins	Fat	Fibre	N-free extract
	Green mass					
< 250 m	64.78	3.44	3.03^{a}	0.88	9.12	18.75^{a}
250–550 m	66.02^{x}	3.01	3.92^{b}	0.94^{a}	7.54^{x}	18.58^{x}
> 550 m	49.49^{y}	4.55	3.09	1.38^{b}	12.56^{y}	28.95^{y,b}
Mean	60.09	3.67	3.35	1.06	9.74	22.09
	Hay					
< 250 m	8.32	7.33	6.08	1.54	28.24	48.50
250-550 m	8.23	6.87	5.37	1.56	27.12	50.86
> 550 m	7.90	7.72	4.75	1.58	26.76	51.30
Mean	8.15	7.30	5.40	1.56	27.37	50.22

Table 2

Energy values of green mass and hay of Divčibare

Localities (above sea level)	Green mass		Hay	
	NEL (MJ/kg DM)	SV (SJ/kg DM)	NEL (MJ/kg DM)	SV (SJ/kg DM)
< 250 m	7.31	0.67	8.10	0.73
250–550 m	7.19	0.68	8.15	0.75
> 550 m	10.56	1.00	8.11	0.74
Mean	8.35	0.78	8.12	0.74

The investigation of the energy value of hay from different localities Divčibare is determined by the average content of the NEL 8.12 MJ/kg DM, and SV 0.74 SJ/kg DM. In relation to the results, Stekar et al. (1994, 1995) cite data below (4.52 MJ/kg and 0.35 SJ/kg DM), and Todorov (1995) and Grbeša (1993) values up to 6.16 MJ/kg. Among other things, the energy value of hay depends on the moment and cutting, the phase of vegetation and the information obtained in the data largely agree that Cilev et al. (2001) state for hay. Bearing in mind the content of energy, hay from Divčibare areas can be classified as medium quality (Sinovec et al., 1995).

In Table 3 with the average energy content (NEL, SV) green mass of hay, as well as loss during drying the green mass, are shown. Losses in the energy values are clearly marked and statistically significant ($p < 0.05$).

Table 3.

Change in energy values [%]

	NEL (MJ/kg DM)	SU (SV/kg DM)	NEL (MJ/kg DM)	SV (SJ/kg DM)
Green mass	3.33	0.31	8.35[a]	0.78[a]
Hay	7.46	0.68	8.12[b]	0.74[b]
Losses (%)	–	–	–2.75	–5.12

$p^{a,b}<0.05$

Changes of the chemical composition are described as a result of losses during the drying process and caused the reduction of the energy value of the examined samples (Fig. 1). The relative increase of the content of cellulose with simultaneous and proportional reduction in protein and lipid content has a negative impact on the organic matter digestibility, as well as on the energy value of hay.

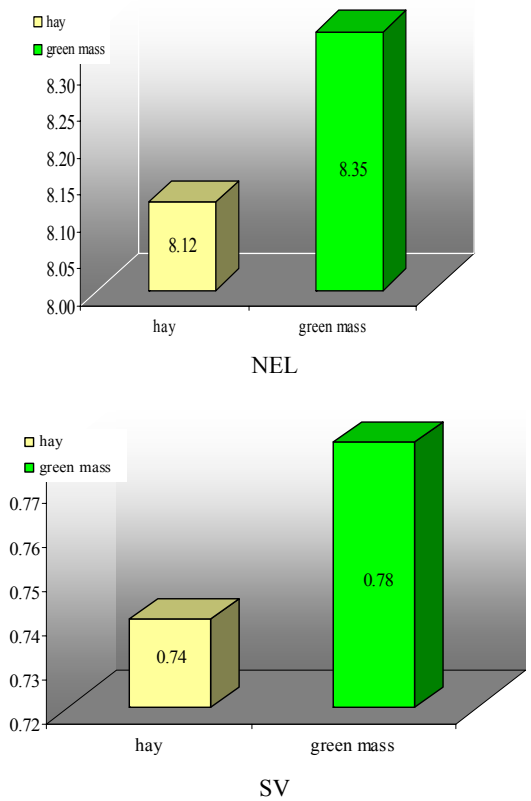

Fig. 1. Energy values of green mass and hay

4. CONCLUSIONS

Investigation of the energy values of green mass and hay from the Divčibare region showed a significant higher nutritive value of green mass, calculated on dry matter, compared to the nutritive value of hay. Those differences are results of haymaking. Nutrients losses during drying are in correlation with decrease levels of proteins, lipids and mineral matter, but there is an increase in fiber. The change in the chemical composition due to the described losses during drying and the negative influence on organic matter digestibility, led to a reduction in the energy value of the investigated samples.

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